

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

12 May 2000 (12.05.00)

International application No.

PCT/FI99/00684

Applicant's or agent's file reference

P1475

International filing date (day/month/year)

18 August 1999 (18.08.99)

Priority date (day/month/year)

21 August 1998 (21.08.98)

Applicant

MATULA, Jouni

1. The designated Office is hereby notified of its election made:

☒

in the demand filed with the International Preliminary Examining Authority on:

15 March 2000 (15.03.00)

☐

in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

F. Baechler

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

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NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

ANDRITZ-AHLSTROM OY
Patent Dept.
P.O. Box 18
FIN-48601 Karhula
FINLANDE

Date of mailing (day/month/year) 24 July 2000 (24.07.00)	
Applicant's or agent's file reference P1475	IMPORTANT NOTIFICATION
International application No. PCT/FI99/00684	International filing date (day/month/year) 18 August 1999 (18.08.99)

1. The following indications appeared on record concerning: <input checked="" type="checkbox"/> the applicant <input type="checkbox"/> the inventor <input type="checkbox"/> the agent <input type="checkbox"/> the common representative		
Name and Address AHLSTROM MACHINERY OY Lars Sonckinkaari 12 FIN-02600 Espoo Finland	State of Nationality FI	State of Residence FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning: <input type="checkbox"/> the person <input type="checkbox"/> the name <input checked="" type="checkbox"/> the address <input type="checkbox"/> the nationality <input type="checkbox"/> the residence		
Name and Address ANDRITZ-AHLSTROM OY Lars Sonckinkaari 12 FIN-02600 Espoo Finland	State of Nationality FI	State of Residence FI
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	
3. Further observations, if necessary: Please note that the name of the agent' has also been changed accordingly, as specified in the addressee box above.		
4. A copy of this notification has been sent to: <div style="display: flex; justify-content: space-between;"> <div> <input checked="" type="checkbox"/> the receiving Office <input type="checkbox"/> the International Searching Authority <input checked="" type="checkbox"/> the International Preliminary Examining Authority </div> <div> <input type="checkbox"/> the designated Offices concerned <input checked="" type="checkbox"/> the elected Offices concerned <input type="checkbox"/> other: </div> </div>		

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Beate Giffo-Schmitt Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

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NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

AHLSTROM MACHINERY OY
Patent Dept.
P.O. Box 18
FIN-48601 Karhula
FINLANDE

Date of mailing (day/month/year) 04 April 2000 (04.04.00)	
Applicant's or agent's file reference P1475	IMPORTANT NOTIFICATION
International application No. PCT/FI99/00684	International filing date (day/month/year) 18 August 1999 (18.08.99)

1. The following indications appeared on record concerning:

☒ the applicant
 ☐ the inventor
 ☐ the agent
 ☐ the common representative

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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person
 ☐ the name
 ☒ the address
 ☐ the nationality
 ☐ the residence

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State of Residence

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Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office <input type="checkbox"/> the International Searching Authority <input type="checkbox"/> the International Preliminary Examining Authority	<input checked="" type="checkbox"/> the designated Offices concerned <input type="checkbox"/> the elected Offices concerned <input type="checkbox"/> other:
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The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer <p style="text-align: center;">Aino Metcalfe</p> Telephone No.: (41-22) 338.83.38
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REC'D 15 NOV 2000

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P1475		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI99/00684	International filing date (day/month/year) 18/08/1999	Priority date (day/month/year) 21/08/1998	
International Patent Classification (IPC) or national classification and IPC D21D5/26			
Applicant ANDRITZ-AHLSTROM OY et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 4 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input checked="" type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand 15/03/2000		Date of completion of this report 13.11.2000	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer Fachin, F Telephone No. +49 89 2399 2057 	

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/FI99/00684

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

Description, pages:

1-11 as published

Claims, No.:

1-18 as published

Drawings, sheets:

1/3-3/3 as published

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description. pages:
- ☐ the claims. Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/FI99/00684

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☒ the entire international application.

☐ claims Nos. .

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos. .

2. A meaningful international preliminary examination report cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Section VIII

1. Independent claim 1 does not meet the requirements of Article 6 PCT because it is not clear. The reasons are the following.
If the main problem to be solved is that of the huge volume mostly due to the volume of the gas separation tank, claim 1 is not clear because it does not contain any features which clearly allow the use of a propeller instead of a pump having a higher energy consumption.
If the main problem to be solved is that of reducing the plant energy consumption improving in the same time the product quality, claim 1 is not clear because, when taken into consideration with the description, it is not clear which are the features solving the posed problem.
From the characterizing part of claim 1 it appears that such features can consist in the use of "a propeller pump", but in the description (see page 10, lines 12 to 18) such a pump can be replaced by a vacuum apparatus.
2. The same arguments of point 1 above are applicable to the independent claim 8 concerning the "apparatus".

Section III

3. Due to the unclarity of the independent claims 1 and 8, no opinion can be given about novelty and inventive step, taking into account that the additional features of the dependent claims concern steps or items which are normally known by a person skilled in the art.

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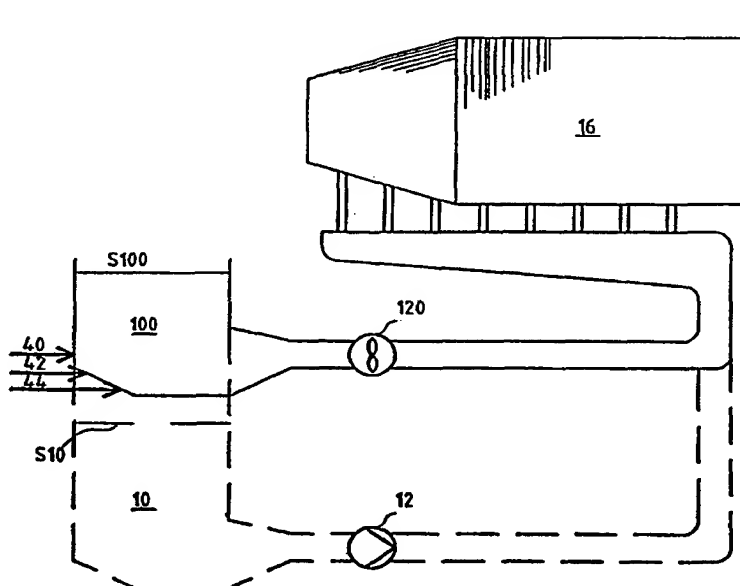
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : D21D 5/26, D21F 1/66		A1	(11) International Publication Number: WO 00/11265
			(43) International Publication Date: 2 March 2000 (02.03.00)
(21) International Application Number: PCT/FI99/00684		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 18 August 1999 (18.08.99)			
(30) Priority Data: 981798 21 August 1998 (21.08.98) FI			
(71) Applicant (for all designated States except US): AHLSTROM MACHINERY OY [FI/FI]; Sentnerikuja 2, FIN-00440 Helsinki (FI).			
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(74) Agent: AHLSTROM MACHINERY OY; Patent Dept., P.O. Box 18, FIN-48601 Karhula (FI).			

(54) Title: METHOD AND APPARATUS FOR PRETREATING PAPER PULP



(57) Abstract

The present invention relates to a method and apparatus for pretreating paper pulp. The method and apparatus according to the invention are especially preferably applicable to be used in the paper machine approach system of paper machines producing filler-containing grades. A characterizing feature of the method and apparatus according to the invention is that a propeller pump is used as the gas separation tank (16) feed pump (120).

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Method and apparatus for pretreating paper pulp

The present invention relates to a method of and apparatus for pretreating paper pulp. The method and apparatus according to the invention are especially preferably applicable to be used in paper machine approach systems in order to optimize the operation of the so-called short circulation.

Almost all prior art paper machine approach systems feeding paper pulp to the paper machine, which are well described in, e.g., US patent publication 4,219,340, comprise the following components: a white water tank, a centrifugal cleaning plant with feed pumps and pumps between various stages, a gas separation tank with vacuum providing means, a fan pump, a head box screen, a paper machine head box, and white water trays. Said components are placed in connection with the paper machine and arranged to operate as follows: The fiber material used for paper making and the fillers which are diluted with the so-called white water obtained from the wire section of the paper machine, are dosed from the machine chest into the white water tank usually located at the bottom level of the mill. By means of a feed pump also located at the bottom level of the mill, the fiber suspension is pumped from the white water tank usually at the machine level of the mill, i.e. the location level of the paper machine, or, as in said patent, to a first cleaning stage of a centrifugal cleaning plant located above it. The centrifugal cleaning plant usually comprises several (most commonly 4 – 6) stages, each typically having a feed pump of its own. By means of pressure created by said feed pump, the fiber suspension accepted in the first cleaning stage of the centrifugal cleaning plant is further conveyed to a gas-separation tank typically located at a level above the machine level. In practice that means about 10 – 12 meters above the surface of the white water tank. In the gas-separation tank the fiber suspension is subjected to the effect of vacuum created by vacuum apparatus, which most commonly are liquid ring pumps, whereby both part of the gas dissolved in the suspension and the gas in the form of

small bubbles in the suspension rises above the surface of the liquid in the tank and is discharged from the tank through the vacuum apparatus. From the gas-separation tank the fiber suspension, wherefrom gas has been removed as thoroughly as possible, flows to a fan pump located at the bottom level of the mill, which feed pump further pumps the fiber suspension to a head box screen (not shown in said US-patent) also located at the bottom level of the mill, whereafter the fiber suspension flows to the machine level into the head box of the paper machine.

One problem in the paper machine approach system of prior art is its huge volume mostly due to the volume of the gas separation tank and the centrifugal cleaning plant as well as the long and large-sized piping. Volume in itself is not a major problem, except for space utilization and the point that it involves relatively big investments, but long delays due to great volumes essentially restrain the grade change and lead to great amounts of broke in connection with the grade change. In connection with the grade change, broke is formed of all the pulp being used to produce the final product before the relative amount of all components of the fiber suspension have been equalized throughout the approach system to correspond to the content of the desired final product.

Said problem has already been dealt with in FI patent 89728, according to which different types of white waters are collected from the wire section of the paper machine and guided directly to the short circulation of the paper machine without employing any actual white water tank. In said publication, under each white water tray there is a pump for delivering the white water to a suitable location. The publication describes the white water channels to be very flat, i.e. of small volume, so that the delays remain as short as possible. In the solution according to said publication, arranged at the side of the wire section there is a small pumping container and means providing pumping operation, from which the white water is further delivered to the process. The deaeration reached by means of this

apparatus is not efficient enough to provide undisturbed operation of the paper machine, though.

In addition to problems related to space utilization and great liquid volume, it may be noticed that the centrifugal cleaning plant creates other problems, too. The traditional location of the centrifugal cleaning plant in the paper machine approach system has been explained on the grounds that the location is chosen to ensure that the fiber suspension just prior to the head box of the paper machine is free of particles unsuitable for paper making, such as sand, bark specks, slivers and even over-sized filler pieces, which may all be called as, e.g., impurities or impurity particles. During the tests we have made we have noticed, however, that especially in the case of paper machines producing filler-containing grades, a major part of the fraction rejected by said centrifugal cleaning plant, that is fraction removed from the flow going to the paper machine head box, is as such suitable for papermaking. One reason for this is that the cyclones of the centrifugal cleaning plant are dimensioned to prevent any unsuitable material from passing into the head box, and, on the other hand, the centrifugal cleaners may be planned to operate in an optimal way with one material only or a few very similar materials. Taking into account e.g. the very different densities of various components, such as e.g. fibers and mineral-based fillers, it is easy to believe that in that kind of application the centrifugal cleaning plant can not perform optimal function with regard to any component, but the basic goal of the centrifugal cleaning plant has to be to keep the ratios of the components in the fiber suspension essentially unchanged during the cleaning and to prevent any particle unsuitable for papermaking from entering the head box of the paper machine. In fact, the same problem is dealt with in FI patents 93753 and 97736, although accepting the presence of reject from the centrifugal cleaning plant.

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One preferable solution to the problem mentioned above is said to be separate treatment of every component of paper pulp: fresh fiber

suspension, pulp broke, recycled fibers, fillers, etc in their own sections prior to mixing the components together. In that case, in each application it is possible to choose the most suitable cleaning method and apparatus for each component. The result is that only clean fractions are introduced to the short circulation of the paper machine and the centrifugal cleaning plant is not needed at all. In addition to that, cleaning every component with an apparatus dimensioned and adapted for that special purpose is essentially more efficient and economical in view of energy consumption and the selection of appropriate devices for performing the cleaning compared with the centrifugal cleaning plant of prior art.

There are still some additional problems caused by the centrifugal cleaning plant. Due to great liquid volume and complex flow piping, the centrifugal cleaning plant tends to, if not directly create fluctuation in paper pulp flow and pulp pressure, at least maintain and possibly strengthen these fluctuations. Further, a complex centrifugal cleaning plant comprising several (most commonly 4 – 6) stages and a large amount of relatively small-sized flow units creates a major flow resistance, the compensation of which using several large-sized centrifugal pumps is very power-consuming. Usually there is a separate feed pump for each cleaning stage of the centrifugal cleaning plant, in which case the total power requirement of all the pumps of the short circulation of the paper machine in an average-sized mill is in the order of 2 MW.

Another factor having an effect on the power consumption of especially pumping is the location of the short circulation components of the mill in relation to each other. The first disadvantage is noticed to be the location of the gas separation tank usually being placed at a level above the machine level. If it would be possible to bring the gas separation tank to the machine level, it would eliminate the need to pump the fiber suspension with the feed pump higher than the machine level. A precondition for this is, though, that the gas separation tank has to be

constructed either to function without overflow, because the functioning of overflow requires a relatively high free fall, in practice from above the machine level to the level under the machine level, or to comprise a pump arranged in connection with the overflow to create the pressure difference ensuring the functioning of the overflow. In other words, the surface level of the gas separation tank (to be more exact, the inlet pressure of the fan pump) could not be determined by means of overflow, when applying the first alternative, but some substitutive method should be found. Because the basic goal of the regulation of the surface level of the gas separation tank is, as already mentioned before, to maintain the inlet pressure of the fan pump constant, it is in fact more economical to use a regulation system taking into account, in addition to the changes in the surface level, also the fluctuations in paper pulp density, which may sometimes be remarkable. As a result, this kind of change will be accompanied by improvement in paper quality and stabilization of the manufacturing process. Thus, the result is a solution that is more economical in view of energy consumption in pumping and, at the same time, has a distinctly positive effect on paper quality and process runnability.

A further factor having an effect on the energy consumption of pumping in the paper machine approach system is the height of the white water tank. The white water tanks, i.e. tanks wherein the so-called white waters from the paper machine are collected, have traditionally been almost ten meters high, relatively large containers located at the bottom level of the paper mill, and the surface level of these tanks has fluctuated a lot. One reason for the differences in the surface level is e.g. the location of the white water tank in connection with the machine. In the case of a so-called fourdrinier machine, the white water tank, in that case also referred to as the wire pit, has been located under the wire section, whereby even constructional reasons have caused the surface level of the white water tank to be relatively low. The surface level of a white water tank arranged at the side of the wire section or the like (a so-called off-machine silo), in turn, is not

always as high as it might in practice be. The big size of the white water tank has been justified on the basis that the presence of a big buffer tank has been regarded as a positive factor stabilizing the process. This has also caused some increase in energy consumption, because at first the feed pump has had to compensate the sometimes low surface level of the white water tank, and extra delays in the process due to the big volume of the white water tank.

Said location of the white water tank at the bottom level of the mill, that is, under the machine level, may be avoided in the approach system according to the invention. The solutions according to the invention make it possible to arrange the white water tank at the machine level, whereby also the gas separation tank feed pump located at the side of the white water tank is placed at the machine level.

When solving said problems e.g. in the way described before, it is possible to develop the paper machine approach system further by employing as gas separation tank feed pump a propeller pump with a substantially smaller power requirement and with a capacity to head ratio essentially better compared to a centrifugal pump. In this case, the stock, either all or at least the main part of it, is fed into the gas separation tank by means of said propeller pump. As to practical characteristics, the propeller pump is better suited for the purpose than the centrifugal pump, but earlier it has not been possible to use it in said application, because the propeller pump has not met the head requirements of prior art processes. Compared to the power requirement of about 2 MW of said prior art apparatus, the employment of one propeller pump results in a power consumption of about 200 kW, i.e. it is possible to save about 90 % of the power needed.

It is possible to develop the paper machine approach system still further according to a preferred embodiment of the invention by totally abandoning said gas separation tank feed pump from the approach

system. In some suitable conditions this may be done simply by bringing the gas separation tank down to the machine level, whereby the pressure difference needed to transfer the fiber suspension, totally or at least the main part of it, from the white water tank to the gas separation tank is so small that it may be created by means of the vacuum apparatus i.e. vacuum pump/s of the gas separation tank. The arrangement according to this embodiment may, if necessary, be provided with a valve for controlling the flow from the white water tank to the gas separation tank.

Some of the advantages of utilizing the method according to the invention are, e.g.:

- overall decrease of reject in papermaking due to more accurate screening,
- more stable operation of the paper machine short circulation,
- smaller flow resistances in the paper machine short circulation,
- space saving in the paper machine short circulation,
- saving of energy needed for pumping,
- shorter delays,
- quick grade change,
- a cleaner process, no microbe growth,
- simple construction – economical investment.

The characteristic features of the method and apparatus according to the invention are described in the appended patent claims.

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In the following, the method and apparatus according to the invention are described in more detail with reference to the appended figures, of which Fig. 1 illustrates mainly a prior art solution according to US-patent 4,219,340,

Fig. 2 illustrates a solution according to a preferred embodiment of the invention, and

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Fig. 3 illustrates a solution according to a second preferred embodiment of the invention.

The prior art approach system illustrated in Fig. 1 comprises a white water tank 10, a feed pump 12, a centrifugal cleaning plant 14 (with several stages not shown), a gas separation tank 16 with its vacuum apparatus 17, a fan pump 18, a head box screen 20, a head box 22 of the paper machine and white water collection channels (not shown). Said components are placed in connection with the paper machine 24 and arranged to operate as follows. Fiber material used in paper making, which may comprise fresh pulp, secondary pulp and/or broke, and fillers which are diluted with the so-called white water obtained from the paper machine, primarily from its wire section, are introduced into the white water tank 10 into which the white waters are collected and which is usually located at the bottom level of the mill in prior art arrangements, to produce paper pulp. By means of a feed pump 12, also located at the bottom level of the mill, said paper pulp is pumped from the white water tank 10 to the centrifugal cleaning plant 14 usually located at the machine level K of the mill (the location level of the paper machine 24), which cleaning plant most usually comprises 4 – 6 stages. Stock accepted by the first stage of the centrifugal cleaning plant 14 proceeds further under pressure created by the feed pump 12 (and with the contributory effect of the vacuum of the gas separation tank) into the gas separation tank 16 located at a level T above the machine level. The gas separation tank 16 typically comprises an overflow to keep the surface level of stock in the tank constant. At the overflow the stock discharged from the tank flows down under the machine level into the white water tank 10 located at the bottom level of the mill. From the gas separation tank 16 the essentially gas-free paper pulp, i.e. pulp from which gas has been removed as thoroughly as possible by means of the vacuum apparatus 17, flows into the fan pump 18 located at the bottom level of the mill, which fan pump pumps the paper pulp further to the head box screen 20 also located at the bottom level of the mill,

wherefrom the accepted paper pulp flows to the machine level K into the head box 22 of the paper machine 24.

Figure 2 illustrates a solution according to a preferred embodiment of the invention in connection with a conventional white water tank 10 of prior art. In the solution according to the figure, three pipelines 40, 42 and 44 are connected with the white water tank 10, each pipeline bringing different fiber pulp into the white water tank. Each pipeline 40 – 44 is connected to its own centrifugal cleaning arrangement 46, 48 and 50 respectively. However, it has to be stated that centrifugal cleaning is by no means the only screening possibility, as pressure screens of new type, preferably provided with slot drums, are very well suitable for the final screening of various pulp fractions. Further, one has to notice that it is also possible to connect all said pipelines together, whereby various sorts of pulp are mixed together prior to the white water tank e.g. in a special mixing tank, wherefrom the stock is taken into a so-called machine chest utilized as a buffer tank. Naturally, this kind of mixing needs appropriate dosing which is not described in this text more precisely as it is considered to be known to any person normally skilled in the art. In this embodiment of the invention, each centrifugal cleaning arrangement 46 - 50 is considered to treat its own sort of pulp e.g. so that arrangement 46 treats the pulp broke from the broke pulper of the paper machine, arrangement 48 recycled fiber pulp and arrangement 50 fresh fiber pulp. The figure further illustrates a pump in connection with each centrifugal cleaning arrangement, with which pumps the different pulps are introduced through the cleaner/s into the white water tank 10. Said pumps may, though, be located in the process remarkably further from the cleaner/s. It is even possible to place various treatment apparatus between the pump and the cleaner/s. With this arrangement, each sort of pulp may be treated as optimally as possible, in other words so that each cleaner may be chosen and run according to optimal screening of the sort of pulp in question. After the cleaners illustrated in the figure, the process may comprise various intermediate

tanks, pumpings or other apparatus needed for treatment of each pulp fraction. Further, the embodiment of the figure illustrates a filler treatment arrangement comprising a mixing/dispersing tank 56, a filler slurry feed pump 58 and a centrifugal cleaning arrangement 54 performing the screening of the filler and a pipeline 52 feeding the screened filler material to between the white water tank 10 and the feed pump 120. This arrangement ensures that only really too big-sized filler particles are removed from the filler material flow and either totally removed from the system or e.g. returned back to the dispersing stage. Thus, this solution prevents the rejecting of fairly big filler particles which are still clearly thinner than the paper, which rejecting would be normal in case of a conventional prior art centrifugal cleaning plant. As feed pump 120, a propeller pump is employed which creates a head that is sufficient at least when e.g. there is no centrifugal cleaning plant creating flow resistance between the pump 120 and the gas separation tank 16. And, as already stated, in some cases the feed pump may be replaced with the vacuum apparatus of the gas separation tank, which vacuum apparatus creates the pressure difference needed for transferring the paper pulp.

Figure 3 illustrates a solution according to a second preferred embodiment of the invention. It relates to a new kind of white water tank 100 located essentially (the main part of the white water tank is above the surface of the machine level and the water level is clearly above the surface of the machine level) at the machine level of the paper mill, into which tank the fiber fractions are brought via pipelines 40 – 44 and which has a surface level at the level S_{100} . The figure illustrates in broken lines a prior art white water tank 10 located at the bottom level of the mill and having a surface level at level S_{10} , and a feed pump 12. In some cases, the height difference between the surface levels of S_{100} and S_{10} is several meters, especially in cases where the wire pit is located under the wire section of the paper machine, whereby the difference in height may be calculated directly in extra consumption of pumping energy in an arrangement

according to prior art. In addition to that, a large-sized white water tank creates in the operation of the process a delay of its own. In the solution according to the figure, the height difference dh between the surface levels of the white water tank 100 and the gas separation tank 16 is less than 9
5 meters, preferably less than 6 meters, suitably 2 – 4 meters, whereby the head requirement of the pump 120 is low enough to fully enable the use of a propeller pump.

It has to be noticed from the above, that although the invention has been
10 described in connection with the paper machine short circulation without a centrifugal cleaning plant, this is only one special embodiment of the method according to the invention. In other words, the method and apparatus according to the invention are applicable also in a short
15 circulation where the centrifugal cleaning plant is located in the traditional position. In that kind of embodiment only some advantages are lost, which would be achievable when applying an embodiment fully in accordance with the invention. Nevertheless, the employment of a propeller pump according to the invention brings such remarkable advantages in all applications that its utilization is always justified.

20 As noticed from the above, a new method of pretreating paper pulp fed to the paper machine has been developed, which method eliminates many drawbacks and disadvantages of prior art and solves problems that have been disturbing the use of prior art approach systems. From the above it
25 has to be noticed, though, that the individual novel features described in different embodiments are applicable independently and by no means inevitably in the connection where they have been presented in the above.

CLAIMS

1. A method of pretreating paper pulp, in which method paper pulp, either totally or at least the main part of it, is fed by means of a gas separation tank feed pump (12, 120) into a gas separation tank (16) and from there by means of a fan pump (18) further to the head box (22) of the paper machine, characterized in that the paper pulp is fed into the gas separation tank (16) by means of a propeller pump (12).
2. A paper pulp pretreatment method according to claim 1, characterized in that prior to being transferred into the gas separation tank (16), of the fractions forming the paper pulp at least the filler fraction and the fiber fraction are treated separately in their own screening stages in order to remove impurities from said fractions, after which said fractions are combined to form paper pulp.
3. A paper pulp pretreatment method according to claim 1, characterized in that various sorts of fiber pulp (e.g. VF, DIP, BR) contained in the paper pulp are treated separately each in its own screening stage.
4. A paper pulp pretreatment method according to claim 2 or 3, characterized in that centrifugal cleaning is used in said screening stages.
5. A paper pulp pretreatment method according to claim 2 or 3, characterized in that a pressure screen is used in said screening stages.
6. A paper pulp pretreatment method according to claim 1, characterized in that the paper pulp is fed by means of a propeller pump (12) into the gas separation tank (16) directly from the white water tank (10) without employing special cleaning.

7. A paper pulp pretreatment method according to claim 1, **characterized** in that the paper pulp is transferred into the gas separation tank (16) from a white water tank (100) located essentially at the machine level.

5

8. An apparatus for pretreating paper pulp, which apparatus comprises at least a gas separation tank feed pump (12), a gas separation tank (16), a fan pump (18) and a head box (22) of a paper machine, **characterized** in that said gas separation tank (16) feed pump is a propeller pump (120),
10 by means of which the paper pulp is fed from the white water tank (10) or the like into the gas separation tank (16).

9. An apparatus according to claim 8, **characterized** in that it comprises in the process order prior to the gas separation tank feed pump
15 (120) both means (54) for screening the filler slurry and means (46, 48, 50) for screening the fiber pulp.

10. An apparatus according to claim 9, **characterized** in that said filler slurry screening means comprise a centrifugal cleaning arrangement (54).

20

11. An apparatus according to claim 9, **characterized** in that said fiber pulp screening means comprise a centrifugal cleaning arrangement (46, 48, 50).

25 12. An apparatus according to claim 9, **characterized** in that said fiber pulp screening means comprise a pressure screen.

13. An apparatus according to claim 9, 11 or 12, **characterized** in that said fiber pulp screening means comprise a special individual screening
30 device (46, 48, 50) for each sort of fiber pulp.

14. An apparatus according to claim 11, 12 or 13, characterized in that said fiber pulp screening devices (46, 48, 50) are located in the process order prior to the white water tank (10) or the like, which, in turn, is located prior to the gas separation tank feed pump.

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15. An apparatus according to claim 8, characterized in that said gas separation tank (16) is provided with means for regulating the inlet pressure of the fan pump (18) without overflow.

10 16. An apparatus according to claim 8, characterized in that the white water tank (100) and the feed pump (120) are located essentially at the machine level (K).

15 17. An apparatus according to claim 16, characterized in that the surface level height difference between the white water tank (100) and the gas separation tank (16) is no more than 9 meters

20 18. An apparatus according to claim 16, characterized in that the surface level height difference between the white water tank (100) and the gas separation tank (16) is preferably less than 6 meters, suitably 2 – 4 meters.

1/3

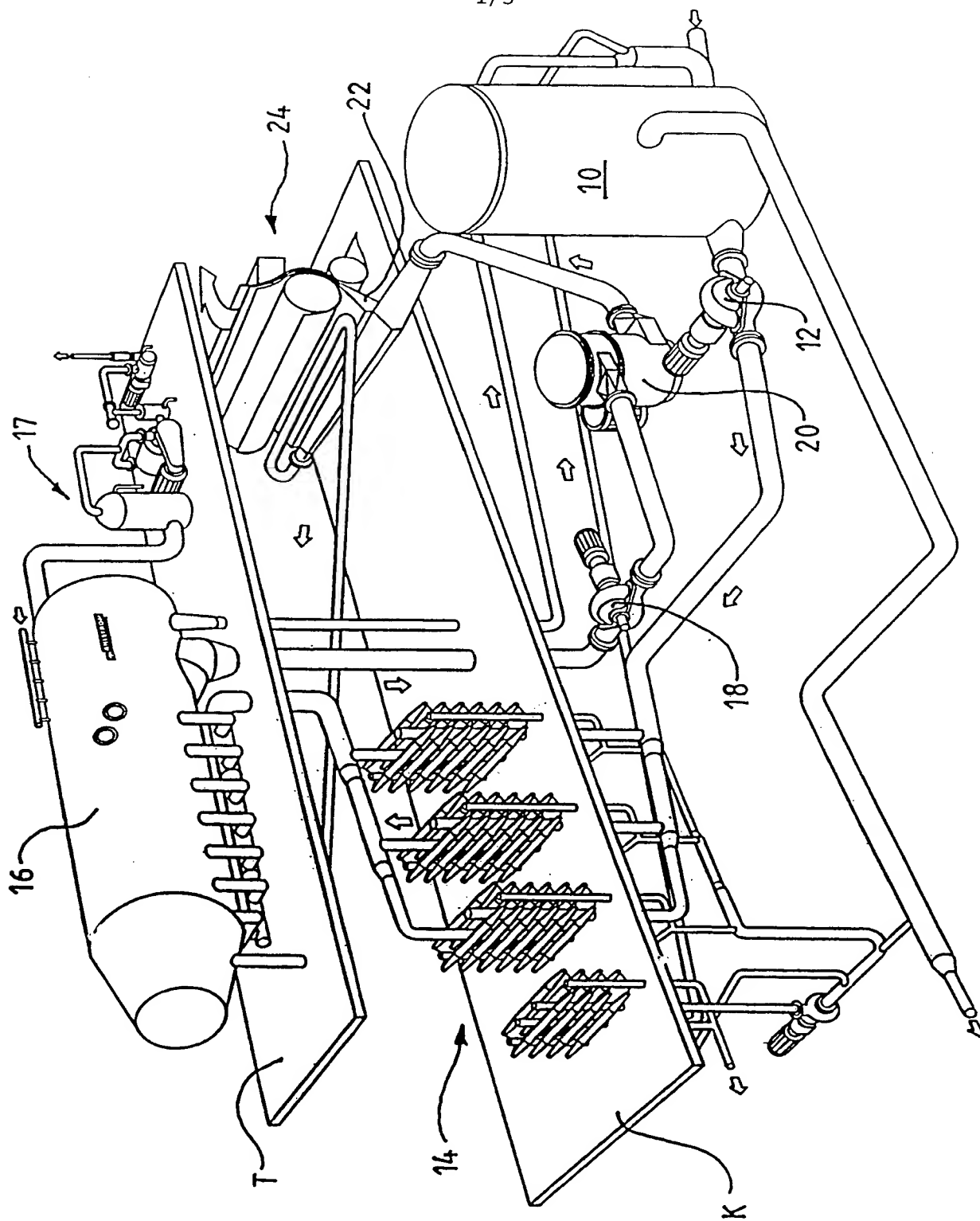


FIG. 1

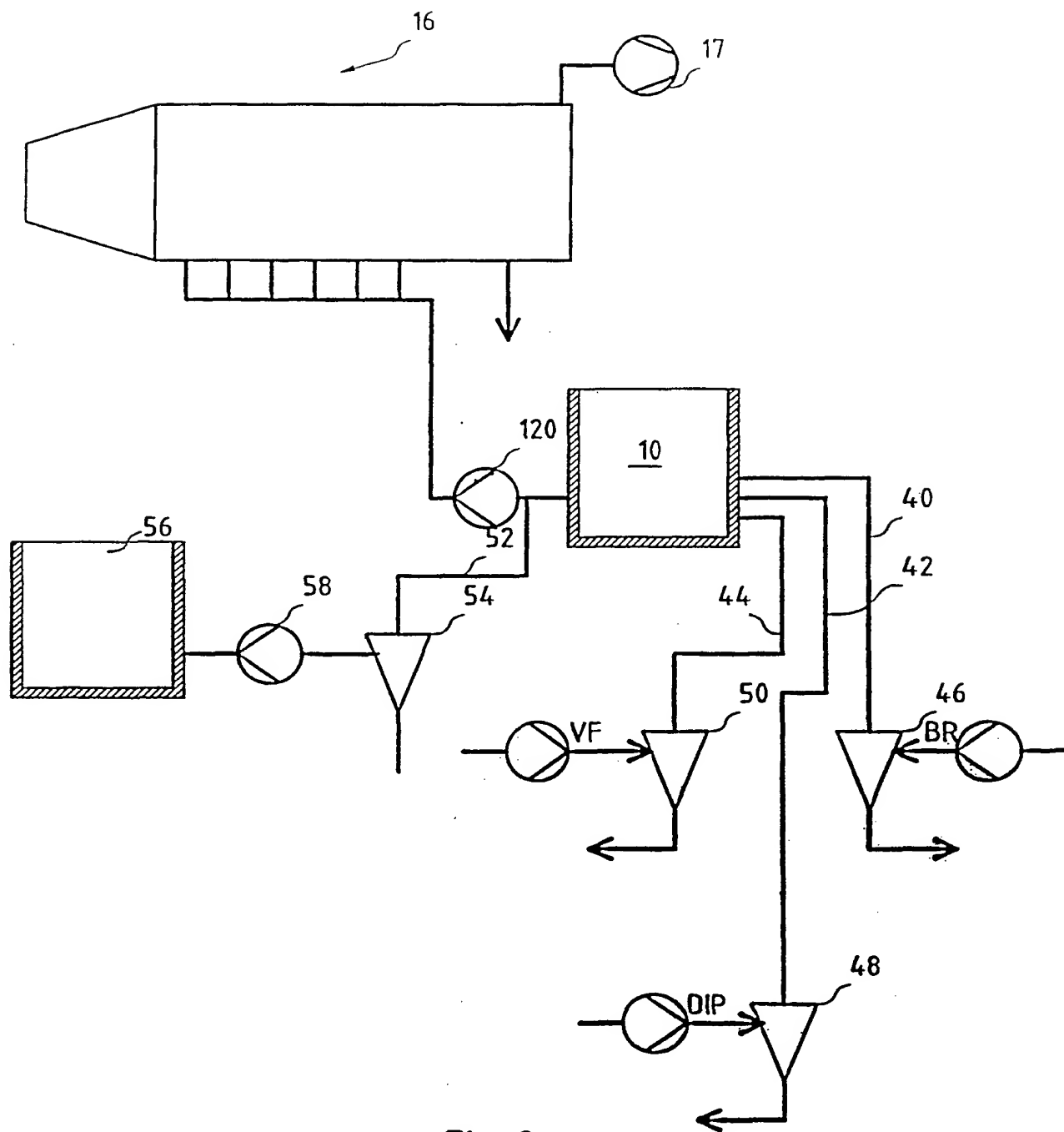


Fig. 2

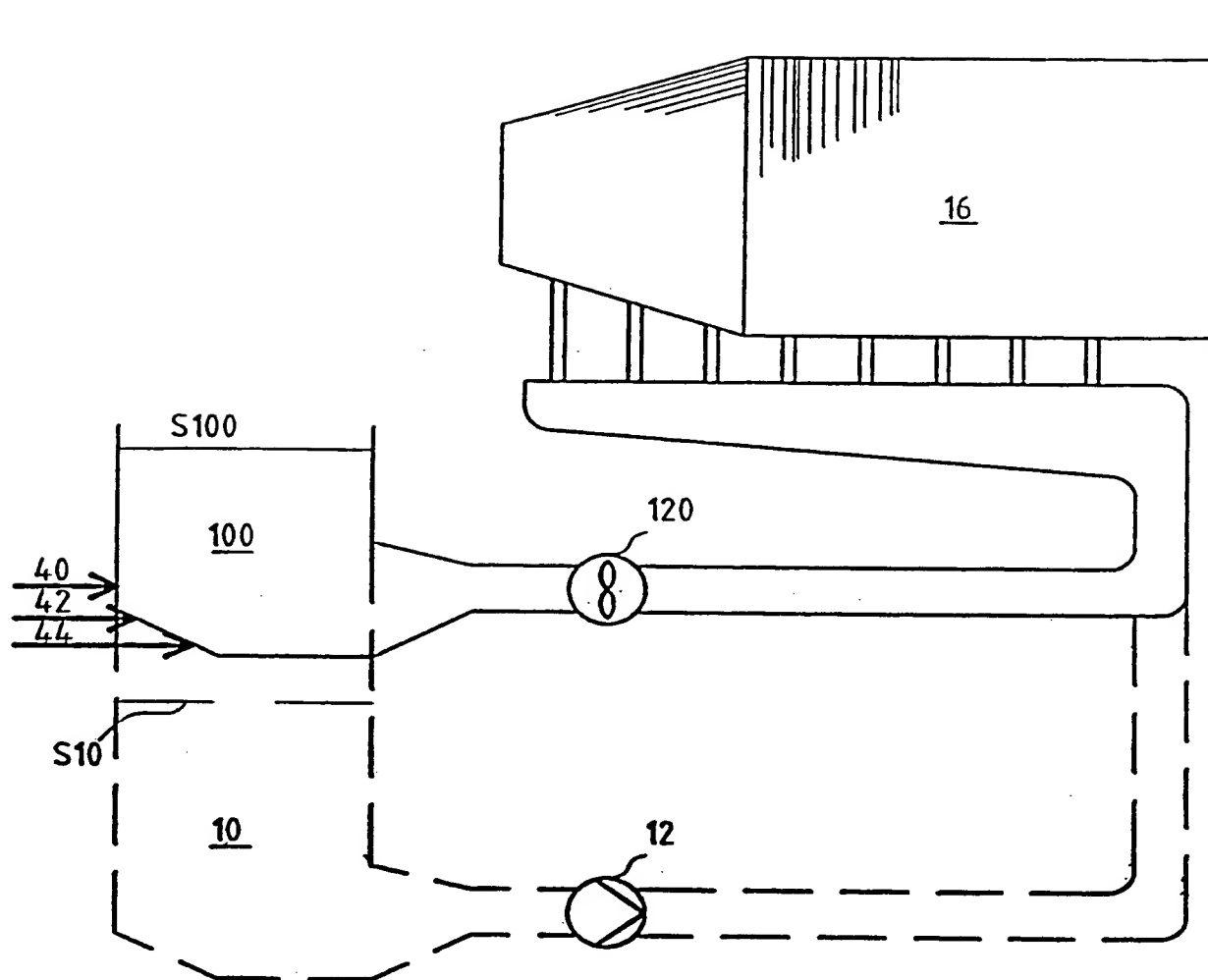


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 99/00684

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21D 5/26, D21F 1/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21D, D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, USTXTE, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4219340 A (ROBERT G. KAISER), 26 August 1980 (26.08.80) --	1-18
A	US 5567278 A (PAUL O. MEINANDER), 22 October 1996 (22.10.96) --	1-18
A	US 5861052 A (PAUL OLOF MEINANDER), 19 January 1999 (19.01.99) -- -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

Date of mailing of the international search report

10 December 1999

14-12-1999

Name and mailing address of the ISA.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/11/99

International application No.

PCT/FI 99/00684

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
US	4219340	A	26/08/80	AR	218796 A	30/06/80
				AT	374515 B	10/05/84
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				JP	8500637 T	23/01/96
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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/11/99

International application No.

PCT/FI 99/00684

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		WO 9619276 A	27/06/96
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PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

receiving Office use only	
International Application No.	PCT/FI 99 / 0 0 6 8 4
International Filing Date	18 AUG 1999 (18. 08. 99)
The Finnish Patent Office PCT International Application	
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum) P1475	

Box No. I TITLE OF INVENTION	
"Method and apparatus for pretreating paper pulp"	
Box No. II APPLICANT	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
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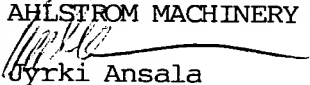
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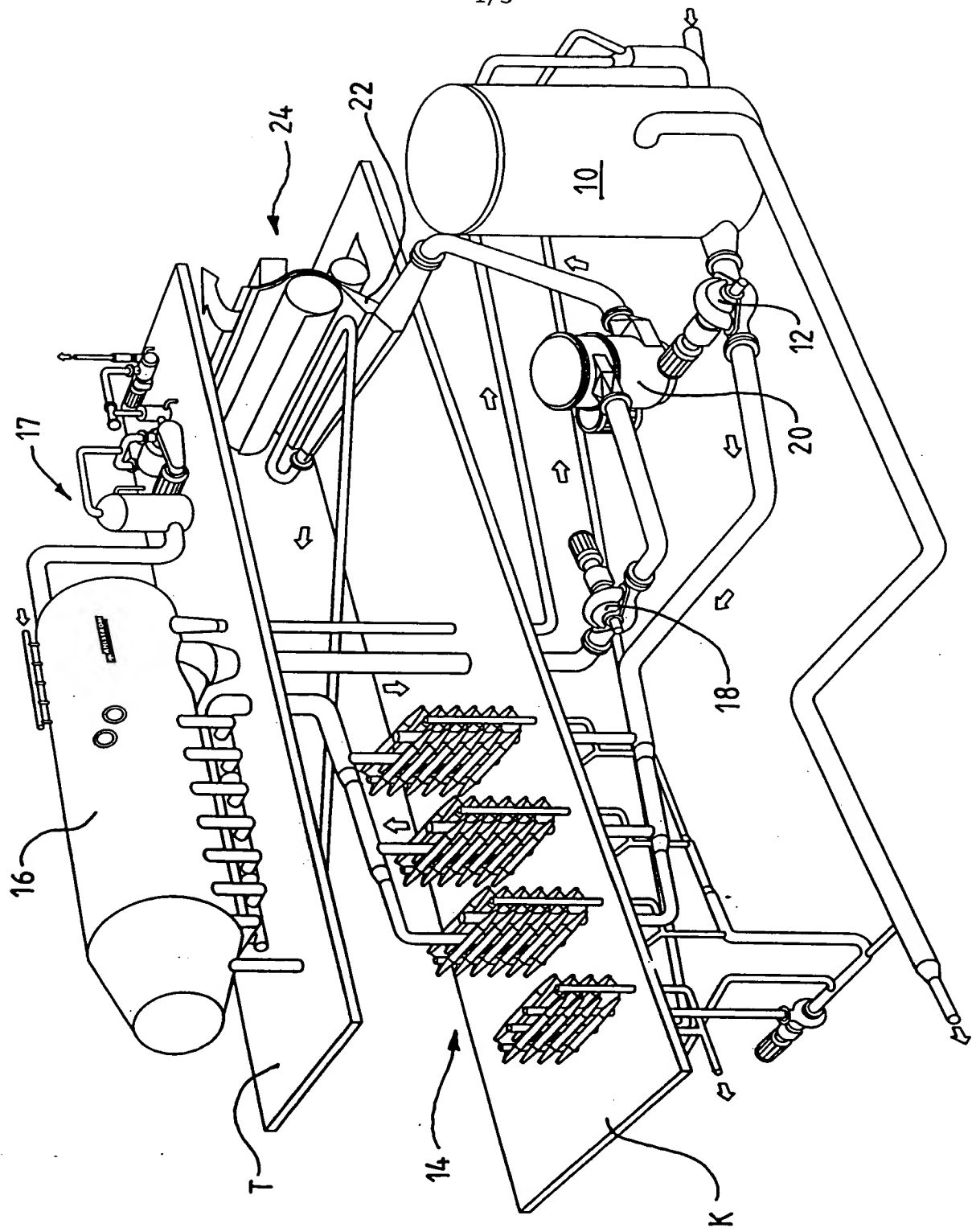


FIG. 1

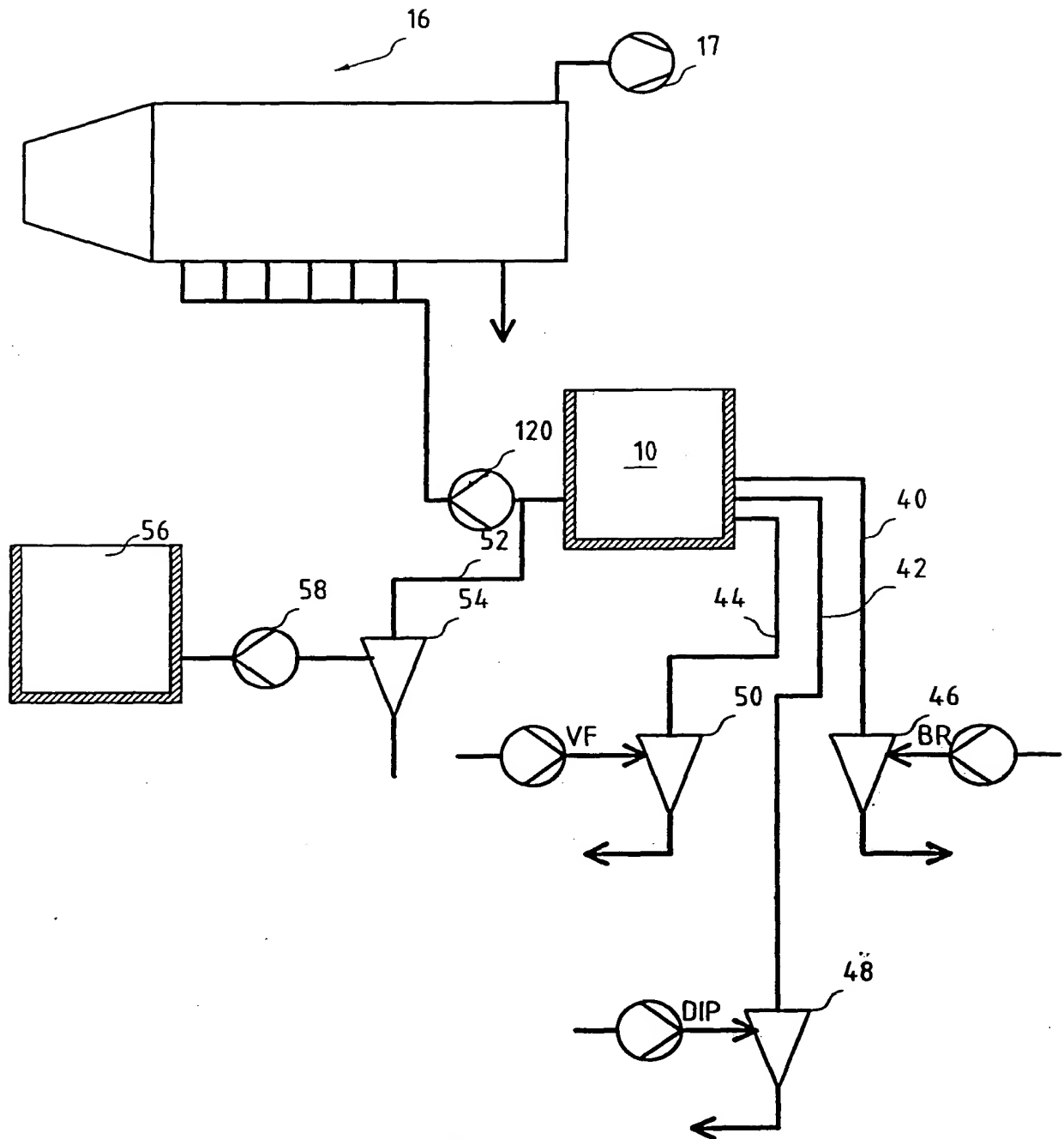


Fig. 2

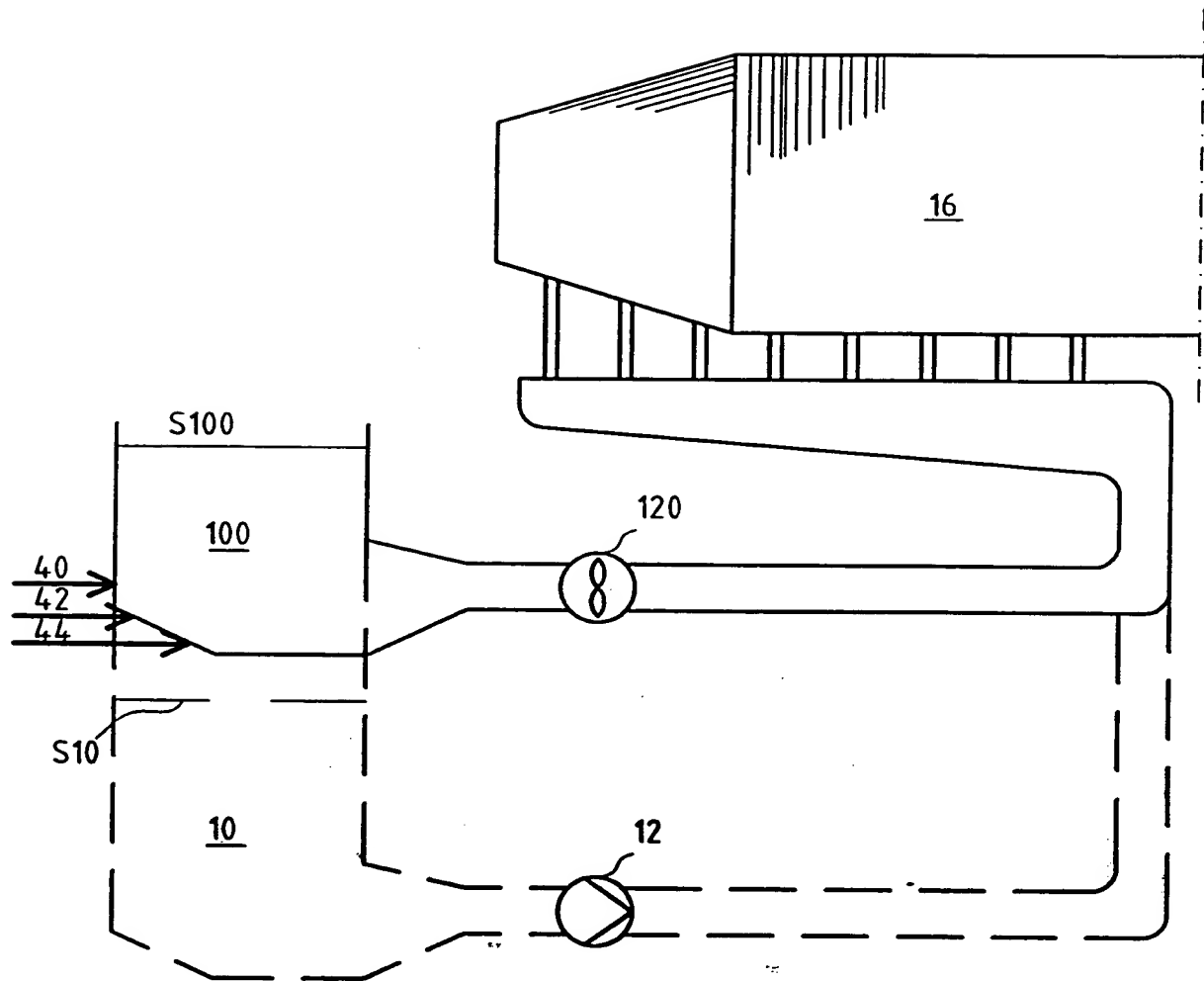


Fig. 3

Menetelmä ja laitteisto paperimassan esikäsittelymiseksi

Esillä olevan keksinnön kohteena on menetelmä ja laitteisto paperimassan esikäsittelymiseksi. Erityisen edullisesti keksinnön mukainen menetelmä ja laitteisto soveltuvat käytettäväksi paperikoneiden lähestymisjärjestelmässä ns. lyhyen kierron toiminnan optimoimiseksi.

Ennalta tunnetun tekniikan mukaiset paperikoneelle paperimassaa syöttävät paperikoneen lähestymisjärjestelmät, joista hyvän käsityksen antaa mm. US patenttijulkaisu 4,219,340, koostuvat lähestulkoon aina seuraavista komponenteista. Viiravesisäiliö, pyörrepuhdistuslaitos syöttöpumppuineen ja eri portaiden välisine pumppuineen, kaasunerotussäiliö tyhjölaitteineen, perälaatikon syöttöpumppu, perälaatikkosihti, paperikoneen perälaatikko ja viiravesien keräilyaltaat. Mainitut komponentit on sijoitettu paperikoneen yhteyteen ja järjestetty toimimaan seuraavasti. Viiravesisäiliöön, joka sijaitsee tavallisesti tehtaan pohjatasolla annostellaan konesäiliöstä paperinvalmistuksessa käytettävä kuituaine ja täyteaineet, joiden laimennukseen käytetään paperikoneen viiraosalta saatavaa ns. viiravettä. Niinikään tehtaan pohjatasolle sijoituvalla syöttöpumpulla kuitususpensio pumpataan viiravesisäiliöstä tavallisesti tehtaan konetasolla, se taso, johon paperikone sijoittuu, tai, kuten em. patentissa, sen yläpuolella olevaan pyörrepuhdistuslaitoksen ensimmäiseen puhdistusportaaseen. Pyörrepuhdistuslaitos käsittää useimmiten useampia (tavallisimmin 4 - 6) portaita, joilla kullakin on tyypillisesti oma syöttöpumppunsa. Pyörrepuhdistuslaitoksen ensimmäisen puhdistusportaan akseptoitu kuitususpensio jatkaa edelleen mainitun syöttöpumpun kehittämällä paineella kaasunerotussäiliöön, joka on tyypillisesti sijoitettu konetason yläpuolella olevalle tasolle. Eli käytännössä noin 10 - 12 metriä viiravesisäiliön pinnan yläpuolelle. Kaasunerotussäiliössä kuitususpensio joutuu tyhjölaitteilla, jotka tavallisimmin ovat nesterengaspumppuja, kehitetyn alipaineen vaikutuksen alaiseksi, jolloin sekä osa suspensiossa liuenneena olevasta kaasusta että suspensiossa pieninä kuplina oleva kaasu kohoaa säiliön nestepinnan yläpuolelle ja poistuu säiliöstä tyhjölaitteiden kautta. Kaasunerotussäiliöstä

kuitususpensio, josta kaasu on mahdollisimman tarkkaan poistettu, virtaa tehtaan pohjatasolla olevalle perälaatikon syöttöpumpulle, joka pumppaa kuitususpension niinikään pohjatasolla olevalle perälaatikkosihdille (ei esitetty em. US patentissa), josta kuitususpensio virtaa konetasolle paperikoneen perälaatikkoon.

Eräänä ongelmana tekniikan tason mukaisessa paperikoneen lähestymisjärjestelmässä on sen suuri tilavuus, joka muodostuu lähinnä kaasunerotussäiliön ja pyörrepuhdistuslaitoksen sekä pitkien ja suurikokoisten putkilinjojen tilavuudesta. Tilavuus itsessään ei ole suurikaan ongelma, paitsi tilankäytölliseltä kannalta ja kohtuullisen suurena investointina, mutta suurista tilavuuksista johtuvat pitkät viiveajat hidastavat lajinvaihtoa olennaisesti ja johtavat suureen hylkymäärään lajinvaihtojen yhteydessä. Lajinvaihdossa nimittäin joutuu hylkyksi kaikki se massamäärä, joka ajetaan lopputuotteeksi ennenkuin kuitususpension kaikkien ainesosasten suhteelliset määrät ovat koko lähestymisjärjestelmässä vakiintuneet vastaamaan halutun lopputuotteen sisältöä.

Kyseistä ongelmaa on jo käsitelty FI patentissa 89728, jossa paperikoneen viiraosalta kerätään erilaisia viiravesiä, joita johdetaan suoraan paperikoneen lyhyeen kiertoan ilman varsinaista viiravesisäiliötä. Kyseisen julkaisun mukaan kunkin viiravesialtaan alapuolelle on sijoitettu pumppu, jolla viiravesi toimitetaan sopivaan kohteeseen. Julkaisussa kuvataan, kuinka viiravesikourut ovat hyvin laakeita s.o. pienitilavuuksisia niin, että viiveet tulevat mahdollisimman pieniksi. Viiraosan sivulle on kyseisen julkaisun mukaisessa ratkaisussa järjestetty pieni pumppaussäiliö ja pumppumaisia laitteita, joista viiravesi toimitetaan edelleen prosessiin. Tällä laiteratkaisulla ei kuitenkaan päästä niin tehokkaaseen ilmanpoistoon, että paperikone toimisi häiriöttä.

Tilankäyttöön ja suureen nestetilavuuteen liittyvien ongelmien lisäksi voidaan pyörrepuhdistuslaitoksen huomata tuovan mukanaan myös muita ongelmia. Pyörrepuhdistuslaitoksen sijoitusta perinteisesti paperikoneen lähestymisjärjestelmään on perusteltu sillä, että halutaan varmistaa, että juuri ennen

paperikoneen perälaatikkoa kuitususpensiossa ei ole paperinvalmistuksen kannalta sopimattomia partikkeleita, kuten hiekkaa, kuoripilkkuja, tikkuja tai ylisuuria täyteainekappaleitakaan, joita kaikkia voidaan kutsua vaikkapa epäpuhtaudeksi tai epäpuhtauspartikkeleiksi. Suorittamissamme kokeissa
5 olemme kuitenkin huomanneet, että etenkin täyteainepitoisia lajeja valmistavilla paperikoneilla suurin osa mainitun pyörrepuhdistuslaitoksen rejektoimasta eli paperikoneelle menevästä virtauksesta poistetusta jakeesta on paperinvalmistukseen sellaisenaan sopivaa materiaalia. Syynä tähän on toisaalta se, että pyörrepuhdistuslaitoksen syklonit on mitoitettu niin, että ne eivät missään
10 tapauksessa päästä epäsooivaa materiaalia perälaatikkoon, ja toisaalta se, että pyörrepuhdistimet voidaan suunnitella toimimaan optimaalisesti vain jollakin materiaalilla tai joillakin toisiaan hyvin paljon muistuttavilla materiaaleilla. Kun otetaan huomioon vaikkapa eri ainesosasten, kuten esimerkiksi kuidut ja mineraalipohjaiset täyteaineet, toisistaan merkittävästi poikkeavat tiheydet, on
15 helppo uskoa, että pyörrepuhdistuslaitos ei voi ao. kohteessa toimia minkään ainesosan kohdalla optimaalisesti, vaan lähtökohtana pyörrepuhdistuslaitoksella täytyy olla, että se pitää ainesosasten suhteet kuitususpensiossa olennaisesti ennallaan puhdistustapahtuman aikana ja että se ei päästä yhtään paperinvalmistuksen kannalta epäsooivaa partikkelia
20 paperikoneen perälaatikkoon. Mainittua ongelmaa, kylläkin pyörrepuhdistuslaitoksen rejektin olemassaolo hyväksyen, on itse asiassa käsitelty FI patenteissa 93753 ja 97736.

Erääksi edulliseksi ratkaisuksi edellä mainitulle ongelmalle esitetään, että kukin
25 paperimassan ainesosa: tuore kuitususpensio, hylkymassa, kierrätyskuitu, täyteaineet jne. käsitellään omassa yksikössään ennen ainesosien sekoittamista keskenään. Tällöin kuhunkin kohteeseen voidaan valita juuri kyseiselle ainesosalle parhaiten sopiva puhdistustapa ja -laite. Seurauksena on, että paperikoneen lyhyeen kiertoon tuodaan vain puhtaita jakeita, eikä
30 pyörrepuhdistuslaitosta tarvita ollenkaan. Lisäksi kunkin ainesosan puhdistaminen juuri tarkoitusta varten mitoitettulla ja sovitettulla laitteella on myös energiataloudellisesti ja laiteteknisesti olennaisesti tehokkaampaa ja taloudellisempaa kuin tekniikan tason mukaisella pyörrepuhdistuslaitoksella.

- Lisäksi pyörrepuhdistuslaitos aiheuttaa vielä eräitä lisäongelmia. Suuresta nestetilavuudesta ja monimutkaisesta virtausputkistosta johtuen pyörrepuhdistuslaitos pyrkii, jos ei ehkä aivan synnyttämään huojuntaa
- 5 paperimassan virtaukseen ja massan paineeseen, niin ainakin ylläpitämään ja mahdollisesti vahvistamaan näitä heilahteluja. Edelleen, useista portaista (tavallisimmin 4 - 6 porrasta) koostuva monimutkainen ja suuren määrän suhteellisen pienikokoisia virtauskappaleita sisältävä pyörrepuhdistuslaitos muodostaa suuren virtausvastuksen, jonka kompensointi useilla suurikokoisilla
- 10 keskipakopumpuilla vaatii paljon sähkötehoa. Yleensä kullakin pyörrepuhdistuslaitoksen puhdistusportaalla on oma syöttöpumpppunsa, jolloin keskikokoisella paperitehtaalla paperikoneen kaikkien lyhyen kierron pumppujen tehontarve on luokkaa 2 MW.
- 15 Eräs toinen etenkin pumppauksen tehonkulutukseen vaikuttava tekijä on lyhyen kierron komponenttien sijoittaminen toistensa suhteen tehtaalla. Ensimmäisenä epäkohtana huomataan kaasunerotussäiliön sijoitus, joka tavallisesti on konetason yläpuolisella tasolla. Mikäli kaasunerotussäiliö voitaisiin tuoda konetasolle syöttöpumpulla ei tarvitsisi pumpata kuitususpensiota
- 20 tarpeettomasti konetasoa korkeammalle. Tämä edellyttää kuitenkin sitä, että kaasunerotussäiliö on konstruoitava joko toimimaan ilman ylijuoksua, koska ylijuoksun toimiminen vaatii suhteellisen korkean vapaan pudotuksen, käytännössä konetason yläpuolelta konetason alapuoliselle tasolle saakka tai käsittämään ylijuoksun yhteyteen järjestetyn pumpun, jolla kehitetään ylijuoksun
- 25 toiminnan takaava paine-ero. Toisin sanoen kaasunerotussäiliön pinnankorkeutta (tarkemmin sanoen perälaatikon syöttöpumpun tulopainetta) ei, ensimmäistä vaihtoehtoa käytettäessä, enää voitaisi määrittää ylijuoksulla, vaan olisi pyrittävä löytämään jokin korvaava tapa. Koska kaasunerotussäiliön pinnankorkeuden säädön perimmäinen tarkoitus on pitää, kuten edellä jo
- 30 mainittiin, perälaatikon syöttöpumpun tulopaine vakiona, on itse asiassa edullisempaa käyttää säätöjärjestelmää, joka ottaa huomioon paitsi pinnankorkeuden vaihtelun myös paperimassan joskus suuretkin tiheyden vaihtelut. Viime kädessä tällainen muutos johtaa myös paperin laadun

parantumiseen ja valmistusprosessin vakioitumiseen. Siten lopputuloksena on paitsi pumppausenergian käytöltään edullisempi, myös paperin laatuun ja prosessin ajettavuuteen selvästi positiivisesti vaikuttava ratkaisu.

- 5 Vielä eräs paperikoneen lähestymisjärjestelmän pumppauksien energiankulutukseen vaikuttava tekijä on viiravesisäiliön korkeus. Viiravesisäiliöt, joihin siis ns. viiravedet paperikoneelta kerätään, ovat perinteisesti olleet lähes kymmenen metrin korkuisia paperitehtaan pohjatasolle sijoittuvia suhteellisen suurikokoisia säiliöitä, joiden pinnankorkeus on vaihdellut paljon. Syynä 10 pinnankorkeuden eroihin on mm. viiravesisäiliön sijoitus koneen yhteydessä. Mikäli kyseessä on ns. tasoviirakone, on viiravesisäiliö, kyseisessä tapauksessa viirakaivoksikin kutsuttu, sijoitettu viiraosan alle, jolloin sen pinnankorkeus jo rakenteellisista syistä johtuen on ollut suhteellisen matalalla. Myöskään viiraosan tai vastaavan sivulle järjestetyn viiravesisäiliön (ns. off-machine silo) 15 pinnankorkeus ei aina ole niin korkealla kuin se käytännössä olisi mahdollista. Viiravesisäiliön suurta kokoa on perusteltu sillä, että on pidetty hyvänä asiana ja prosessia stabiloivana tekijänä, että on olemassa iso puskurisäiliö. Myös tästä on seurannut sekä jonkin verran ylimääräistä energiankulutusta, koska ensimmäisenä syöttöpumpulla on ollut kompensoitavana viiravesisäiliön joskus 20 matalakin pinnankorkeus, että ylimääräisiä viiveitä prosessiin johtuen viiravesisäiliön suuresta tilavuudesta.

Kyseinen viiravesisäiliön sijoittuminen tehtaan pohjatasolle eli konetason alapuolelle on keksinnön mukaisessa lähestymisjärjestelmässä mahdollista 25 välttää. Keksinnön mukaiset ratkaisut antavat mahdollisuuden järjestää viiravesisäiliö konetasolle, jolloin myös viiravesisäiliön rinnalle sijoittuva kaasunerotussäiliön syöttöpumppu sijoittuu konetasolle.

Ratkaisemalla edellä mainittuja ongelmia mm. edellä kuvatulla tavalla voidaan 30 paperikoneen lähestymisjärjestelmää kehittää edelleen ottamalla käyttöön kaasunerotussäiliön syöttöpumppuna oleellisesti vähemmän sähkötehoa kuluttava potkuripumppu, jonka tuotto suhteessa nostokorkeuteen on olennaisesti keskipakopumpun vastaavaa parempi. Tällöin paperimassa, joko

kokonaan tai ainakin sen pääosa, syötetään kaasunerotussäiliöön kyseisellä potkuripumpulla. Käytännön ominaisuuksiltaan potkuripumppu soveltuu tehtävänsä keskipakopumppua paremmin, mutta aiemmin sen käyttö ei kyseisessä kohteessa ole tullut kysymykseen, koska potkuripumppu ei ole

5 täyttänyt tekniikan tason mukaisten prosessien nostokorkeusvaatimuksia. Verrattuna jo edellä mainittuun tekniikan tason mukaisen laitteiston vaatimaan noin 2 MW:n tehontarpeeseen päästään yhtä potkuripumppua käyttämällä noin 200 kW:n tehonkulutukseen eli noin 90% sähkötehosta voidaan säästää.

10 Paperikoneen lähestymisjärjestelmää voidaan kehittää vielä edelleen keksinnön erään edullisen suoritusmuodon mukaisesti siten, että jätetään kyseinen kaasunerotussäiliön syöttöpumppu kokonaan pois lähestymisjärjestelmästä. Tämän tekee mahdolliseksi joissakin sopivissa olosuhteissa pelkästään se, että kaasunerotussäiliö tuodaan alas konetasolle, jolloin tarvittava paine-ero

15 kuituspension, joko kokonaan tai ainakin sen pääosan, siirtämiseksi viiravesisäiliöstä kaasunerotussäiliöön on niin pieni, että se voidaan synnyttää kaasunerotussäiliön tyhjölaitteiden eli tyhjöpumpun/-pumppujen avulla. Tarvittaessa tämän suoritusmuodon mukaiseen järjestelmään voidaan järjestää myös venttiili, jolla säädetään virtausta viiravesisäiliöstä kaasunerotussäiliöön.

20

Keksinnön mukaisella menetelmällä saavutettavia etuja ovat mm. seuraavat:

- paperinvalmistuksen rejektin kaikkalainen väheneminen tarkemman lajittelun vuoksi,
- paperikoneen lyhyen kierron vakaampi toiminta,
- 25 - paperikoneen lyhyen kierron pienemmät virtausvastukset,
- tilansäästö paperikoneen lyhyessä kierrossa,
- pumppausenergian säästö,
- lyhyemmät viiveet,
- nopea lajinvaihto,
- 30 - puhtaampi prosessi, ei mikrobikasvustoja,
- yksinkertainen rakenne - edullinen investointi.

-

Keksinnön mukaiselle menetelmälle ja laitteistolle tunnusmerkilliset piirteet käyvät ilmi oheisista patenttivaatimuksista.

- Seuraavassa keksinnön mukaista menetelmää ja laitteistoa selitetään yksityiskohtaisemmin viittaamalla oheisiin kuvioihin, joista
- 5 kuvio 1 esittää pääosin US patentin 4,219,340 mukaista tekniikan tason mukaista ratkaisua,
- kuvio 2 esittää keksinnön erään edullisen suoritusmuodon mukaista ratkaisua, ja
- 10 kuvio 3 esittää keksinnön erään toisen edullisen suoritusmuodon mukaista ratkaisua.

- Kuvioissa 1 esitettyyn tekniikan tason mukaisen paperikoneen lähestymisjärjestelmään kuuluu viiravesisäiliö 10, syöttöpumppu 12,
- 15 pyörrepuhdistuslaitos 14 (monine portaineen, joita ei ole esitetty), kaasunerotussäiliö 16 tyhjölaitteineen 17, perälaatikon syöttöpumppu 18, perälaatikkosihti 20, paperikoneen perälaatikko 22 ja viiravesien keräilyrännit (ei esitetty). Mainitut komponentit on sijoitettu paperikoneen 24 yhteyteen ja järjestetty toimimaan seuraavasti. Viiravesisäiliöön 10, johon viiravedet
- 20 kerätään, ja joka sijaitsee tavallisesti tekniikan tason mukaisissa järjestelmissä tehtaan pohjatasolla annostellaan konesäiliöstä paperinvalmistuksessa käytettävä kuituaine, joka voi koostua tuoreesta massasta, toisiomassasta ja/tai hylystä, ja täyteaineet, joiden laimennukseen käytetään paperikoneelta, lähinnä sen viiraosalta saatavaa ns. viiravettä, paperimassan muodostamiseksi.
- 25 Niinikään tehtaan pohjatasolle sijoittuvalla syöttöpumpulla 12 kyseinen paperimassa pumpataan viiravesisäiliöstä 10 tavallisesti tehtaan konetasolla K (se taso, johon paperikone 24 sijoittuu) olevaan pyörrepuhdistuslaitokseen 14, joka tavallisimmin käsittää 4 - 6 porrasta. Pyörrepuhdistuslaitoksen 14 ensimmäisen portaan akseptoima paperimassa jatkaa edelleen mainitun
- 30 syöttöpumpun 12 kehittämällä paineella (ja kaasunerotussäiliön alipaineen avustuksella) kaasunerotussäiliöön 16, joka on sijoitettu konetason yläpuolella olevalle tasolle T. Kaasunerotussäiliöön 16 kuuluu tyypillisesti ylijuoksu, jolla paperimassan pinnankorkeus säiliössä pidetään vakiona. Ylijuoksulla säiliöstä

poistettu paperimassa virtaa alas konetason alapuolelle tehtaan pohjatasolla olevaan viiravesisäiliöön 10. Kaasunerotussäiliöstä 16 olennaisesti kaasuton paperimassa, josta siis kaasu on mahdollisimman tarkkaan tyhjölaitteilla 17 poistettu, virtaa tehtaan pohjatasolla olevalle perälaatikon syöttöpumpulle 18, 5 joka pumppaa paperimassan niinikään pohjatasolla olevalle perälaatikkosihdille 20, josta akseptoitu paperimassa virtaa konetasolle K paperikoneen 24 perälaatikkoon 22.

Kuviossa 2 esitetään keksinnön erään edullisen suoritusmuodon mukainen 10 ratkaisu yhdistettynä tekniikan tason mukaisen perinteiseen viiravesisäiliöön 10. Kuvion mukaisessa ratkaisussa viiravesisäiliöön 10 on liitetty kolme putkilinjaa 40, 42 ja 44, joista kukin tuo viiravesisäiliöön erilaista kuitumassaa. Kukin putkilinjoista 40 - 44 on liitetty omaan pyörrepuhdistinjärjestelyynsä 46, 48 ja 50, vastaavasti. On kylläkin todettava, että pyörrepuhdistus ei suinkaan ole 15 ainoa lajittelumahdollisuus, vaan uudentyyppiset painelajittimet, edullisesti varustettuina rakorummuilla, tulevat hyvin kyseeseen erilaisten massajakeiden viimeistelylajittelussa. Edelleen on huomattava, että on myös mahdollista yhdistää kaikki mainitut putkilinjat, jolloin eri massalajit sekoitetaan keskenään jo ennen viiravesisäiliötä esimerkiksi erityisessä sekoitussäiliössä, josta 20 paperimassa viedään puskurisäiliönä toimivaan ns. konesäiliöön. Luonnollisesti tällaisessa sekoituksessa tarvitaan asianmukaista annostelua, jota ei ole tässä tarkemmin kuvattu, koska sen katsotaan kuuluvan alan ammattimiehen tavanomaiseen tekniseen tietämykseen. Keksinnön tässä suoritusmuodossa on ajateltu kunkin pyörrepuhdistinjärjestelynsä 46 - 50 käsittelevän omaa 25 massalajiaan esimerkiksi niin, että järjestely 46 käsittelee paperikoneelta hylkymassapulperilta peräisin olevaa hylkymassa, järjestely 48 keräyskuitumassaa ja järjestely 50 tuoretta kuitumassaa. Kuvioon on vielä piirretty kunkin pyörrepuhdistinjärjestelyn yhteyteen pumppu, jolla eri massat syötetään puhdistimen/puhdistimien kautta viiravesisäiliöön 10. Tosin kyseiset 30 pumput voivat sijoittua prosessissa myös huomattavasti kauemmas puhdistimesta/puhdistimista. Jopa erilaisia käsittelylaitteita voi sijoittua pumpun ja puhdistimen/puhdistimien välille. Tällä järjestelyllä kutakin massalajia voidaan käsitellä mahdollisimman optimaalisesti, toisin sanoen siten, että kukin

puhdistin voidaan valita ja kutakin puhdistimista voidaan ajaa juuri kyseisen massalajin optimaalisen lajittelun mukaisesti. Kuviossa esitettyjen puhdistimien jälkeen voi prosessiin kuulua erilaisia välisäiliöitä, pumppauksia tai muita kunkin massajakeen käsittelyn vaatimia laitteita. Lisäksi kuvion suoritusmuodossa

5 esitetään täyteaineen käsittelyjärjestelmä, johon kuuluu sekoitus-/dispergointisäiliö 56, täyteainelietteen syöttöpumppu 58 ja täyteaineen lajittelua hoitava pyörrepuhdistinjärjestely 54 sekä lajitellun täyteaineen viiravesisäiliön 10 ja syöttöpumpun 120 välille syöttävä putkilinja 52. Tällä järjestelyllä varmistetaan se, että ainoastaan todellisuudessaakin liian suuret

10 täyteainepartikkelit poistetaan täyteainevirrasta ja joko poistetaan kokonaan järjestelmästä tai esimerkiksi palautetaan takaisin dispergointivaiheeseen. Siten tällä ratkaisulla estetään suurehkojen, mutta selkeästi paperin paksuutta ohuempien täyteainepartikkelien rejektoituminen, mikä olisi normaalia tavanomaisen tekniikan tason mukaisen pyörrepuhdistinlaitoksen yhteydessä.

15 Syöttöpumppuna 120 käytetään potkuripumppua, jonka kehittämä nostokorkeus riittää silloin, kun pyörrepuhdistuslaitos ei ole kehittämässä virtausvastusta pumpun 120 ja kaasunerotussäiliön 16 välille. Ja, kuten jo edellä mainittiin, voidaan syöttöpumppu joissakin tapauksissa korvata kaasunerotussäiliön tyhjölaitteistolla, jolla kehitetään paperimassan siirtoon

20 tarvittava paine-ero.

Kuviossa 3 on esitetty keksinnön erään toisen edullisen suoritusmuodon mukainen ratkaisu. Kyseessä on nimittäin uudentyyppinen olennaisesti (pääosa viiravesisäiliöstä on konetason pinnan yläpuolella ja veden pinta selvästi

25 konetason pinnan yläpuolella) paperitehtaan konetasolle sijoittuva viiravesisäiliö 100, johon kuitujakeet tuodaan putkilinjoja 40 - 44 pitkin ja jossa pinta on korkeudella S_{100} . Kuvioon on katkoviivoilla piirretty tekniikan tason mukainen tehtaan pohjatasolle sijoittuva viiravesisäiliö 10, jonka pinta on korkeudella S_{10} , ja syöttöpumppu 12. Joissakin tapauksissa pintojen S_{100} ja S_{10} korkeusero on

30 useampia metrejä, etenkin tapauksissa, joissa viirakaivo on paperikoneen viiraosan alla, jolloin korkeusero on suoraan laskettavissa pumppausenergian ylimääräisenä kulutuksena tekniikan tason mukaisessa järjestelmässä. Lisäksi vielä suurikokoinen viiravesisäiliö aiheuttaa oman viiveensä prosessin

toimintaan. Kuvion mukaisessa ratkaisussa viiravesisäiliön 100 pinnankorkeuden ja kaasunerotussäiliön 16 pinnankorkeuden ero dh on alle 9 metriä, edullisesti alle 6 metriä, sopivasti 2 - 4 metriä, jolloin pumpun 120 nostokorkeustarve on niin pieni, että potkuripumpun käyttö tulee täysin
5 mahdolliseksi.

Edellä esitetystä on kuitenkin huomattava, että, vaikka keksintöämme onkin esitetty sellaisen paperikoneen lyhyen kierron yhteydessä, jossa ei ole pyörrepuhdistuslaitosta, on tämä kuitenkin vain eräs keksintömme mukaisen
10 menetelmän erityinen sovellutusmuoto. Toisin sanoen keksintömme mukainen menetelmä ja laitteisto toimivat myöskin sellaisessa lyhyessä kierrossa, jossa pyörrepuhdistuslaitos on tavanomaisessa positiossaan. Tällöin ainoastaan joitakin etuja menetetään, jotka olisivat saavutettavissa keksintöämme täysin sovellettaessa. Kuitenkin keksintömme mukainen potkuripumpun käyttö tuo
15 mukanaan kaikissa sovellutuskohteissa niin merkittäviä etuja, että sen käyttö puoltaa aina paikkaansa.

Kuten edellä esitetystä huomataan, on pystytty kehittämään uudentyyppinen paperikoneelle syötettävän paperimassan esikäsittelymenetelmä, joka poistaa
20 monia tunnetun tekniikan heikkouksia ja haittapuolia sekä ratkaisee ongelmia, jotka ovat haitanneet tekniikan tason mukaisten lähestymisjärjestelmien käyttöä. Edellä esitetystä on kuitenkin huomattava, että eri suoritusmuodoissa esitetyt yksittäiset uutuudet ovat sovellettavissa yksinään eivätkä suinkaan välttämättä siinä yhteydessä, jossa ne on edellä esitetty.

25

PATENTTIVAATIMUKSET

1. Menetelmä paperimassan esikäsittelymenetelmäksi, jossa menetelmässä paperimassa, joko kokonaan tai ainakin sen pääosa, syötetään
5 kaasunerotussäiliön syöttöpumpulla (12, 120) kaasunerotussäiliöön (16), josta edelleen paperikoneen perälaatikolle (22) sen syöttöpumpulla (18), **tunnettu** siitä, että paperimassa syötetään kaasunerotussäiliöön (16) potkuripumpulla (12).
- 10 2. Patenttivaatimuksen 1 mukainen paperimassan esikäsittelymenetelmä, **tunnettu** siitä, että ennen kaasunerotussäiliöön (16) siirtämistä paperimassan muodostavista jakeista ainakin täyteainekseä ja kuitujakeita käsitellään erikseen omissa lajitteluvaiheissaan epäpuhtauksien poistamiseksi mainituista jakeista, jonka jälkeen mainitut jakeet yhdistetään paperimassan muodostamiseksi.
- 15 3. Patenttivaatimuksen 1 mukainen paperimassan esikäsittelymenetelmä, **tunnettu** siitä, että paperimassan sisältämät eri kuitumassalajit (esim. VF, DIP, BR) käsitellään erikseen kukin omassa lajitteluvaiheessaan.
- 20 4. Patenttivaatimuksen 2 tai 3 mukainen paperimassan esikäsittelymenetelmä, **tunnettu** siitä, että mainituissa lajitteluvaiheissa käytetään pyörrepuhdistusta.
5. Patenttivaatimuksen 2 tai 3 mukainen paperimassan
25 esikäsittelymenetelmä, **tunnettu** siitä, että mainituissa lajitteluvaiheissa käytetään painelajitinta.
6. Patenttivaatimuksen 1 mukainen paperimassan esikäsittelymenetelmä, **tunnettu** siitä, että paperimassa syötetään potkuripumpulla (12)
30 kaasunerotussäiliöön (16) suoraan viiravesisäiliöstä (10) ilman erityistä puhdistusta.

7. Patenttivaatimuksen 1 mukainen paperimassan esikäsittelymenetelmä, tunnettu siitä, että paperimassa siirretään kaasunerotussäiliöön (16) olennaisesti konetasolla olevasta viiravesisäiliöstä (100).

5 8. Laitteisto paperimassan esikäsitlemiseksi, johon laitteistoon kuuluu ainakin kaasunerotussäiliön syöttöpumppu (12), kaasunerotussäiliö (16), perälaatikon syöttöpumppu (18) ja paperikoneen perälaatikko (22), tunnettu siitä, että mainittu kaasunerotussäiliön (16) syöttöpumppu on potkuripumppu (120), jolla paperimassa syötetään viiravesisäiliöstä (10) tai vastaavasta
10 kaasunerotussäiliöön (16).

9. Patenttivaatimuksen 8 mukainen laitteisto, tunnettu siitä, että siihen kuuluu prosessijärjestyksessä ennen kaasunerotussäiliön syöttöpumppua (120) sekä laitteet (54) täyteainelietteen lajittelemiseksi että laitteet (46, 48, 50)
15 kuitumassan lajittelemiseksi.

10. Patenttivaatimuksen 9 mukainen laitteisto, tunnettu siitä, että mainittuihin täyteainelietteen lajittelulaitteisiin kuuluu pyörrepuhdistinjärjestely (54).
20

11. Patenttivaatimuksen 9 mukainen laitteisto, tunnettu siitä, että mainittuihin kuitumassan lajittelulaitteisiin kuuluu pyörrepuhdistinjärjestely (46, 48, 50).

25 12. Patenttivaatimuksen 9 mukainen laitteisto, tunnettu siitä, että mainittuihin kuitumassan lajittelulaitteisiin kuuluu painelajitin.

13. Patenttivaatimuksen 9, 11 tai 12 mukainen laitteisto, tunnettu siitä, että mainittuihin kuitumassan lajittelulaitteisiin kuuluu oma erityinen lajittelulaite (46, 48, 50) kullekin kuitumassalajille.
30

14. Patenttivaatimuksen 11, 12 tai 13 mukainen laitteisto, tunnettu siitä, että mainitut kuitumassan lajittelulaitteet (46, 48, 50) sijoittuvat prosessijärjestyk-

sessä ennen viiravesisäiliötä (10) tai vastaavaa joka puolestaan sijoittuu ennen kaasunerotussäiliön syöttöpumppua.

5 15. Patenttivaatimuksen 8 mukainen laitteisto, tunnettu siitä, että kyseinen kaasunerotussäiliö (16) on varustettu laitteilla perälaatikon syöttöpumpun (18) tulopaineen säätämiseksi ilman ylijuoksua.

10 16. Patenttivaatimuksen 8 mukainen laitteisto, tunnettu siitä, että viiravesisäiliö (100) ja syöttöpumppu (120) sijoittuvat olennaisesti konetasolle (K).

15 17. Patenttivaatimuksen 16 mukainen laitteisto, tunnettu siitä, että viiravesisäiliön (100) ja kaasunerotussäiliön (16) pinnankorkeuksien ero on enintään 9 metriä.

18. Patenttivaatimuksen 16 mukainen laitteisto, tunnettu siitä, että viiravesisäiliön (100) ja kaasunerotussäiliön (16) pinnankorkeuksien ero on edullisesti alle 6 metriä, sopivasti 2 - 4 metriä.

(57) Tiivistelmä

Esillä olevan keksinnön kohteena on menetelmä ja laitteisto paperimassan
5 esikäsittelymiseksi. Erityisen edullisesti keksinnön mukainen menetelmä ja laitteisto soveltuvat käytettäväksi täyteainepitoisia lajeja valmistavien paperikoneiden lähestymisjärjestel-
10 mässä.

Keksinnön mukaiselle menetelmälle ja laitteistolle on ominaista, että kaasunerotussäiliön (16) syöttöpump-
15 puna (120) käytetään potkuripump-
pua.

(Fig. 3)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 99/00684

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21D 5/26, D21F 1/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21D, D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, USTXTE, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5567278 A (PAUL O. MEINANDER), 22 October 1996 (22.10.96) --	1-18
A	US 5861052 A (PAUL OLOF MEINANDER), 19 January 1999 (19.01.99) -- -----	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
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- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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International application No.

PCT/FI 99/00684

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